

AIRS Application for drought and fire: Current status and future plans

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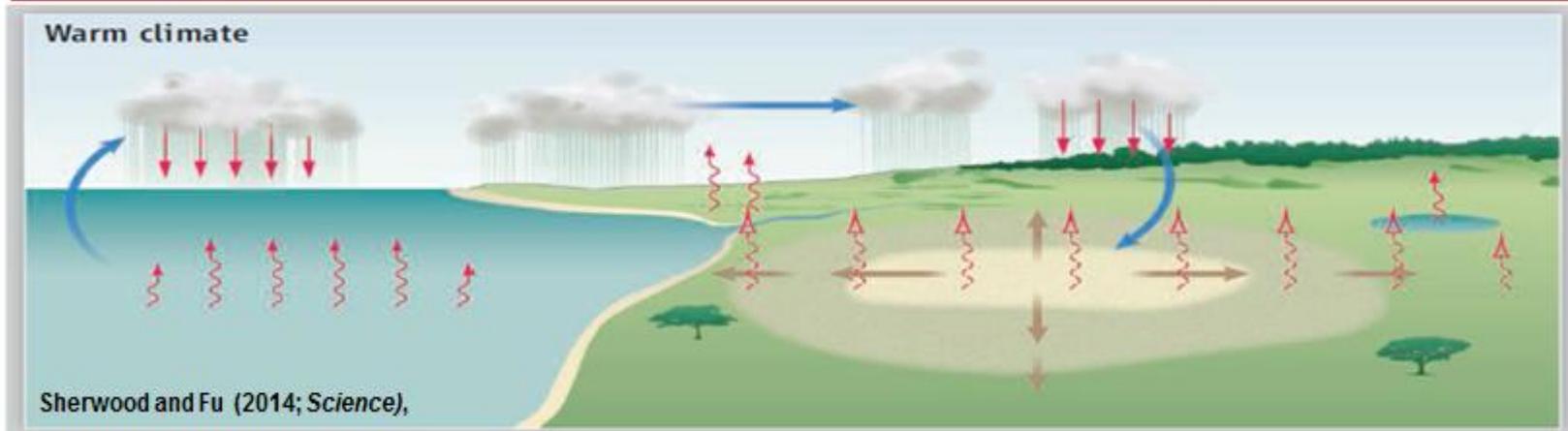
Thanks to:

Steve Licata, Yixin Wen, Alireza Farahmand



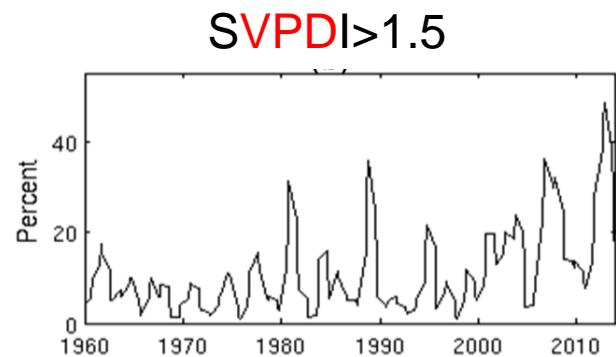
Why AIRS data ?

The key factor in drying over land is that land surfaces (and the air just above them) warm, on average, about 50% more than ocean surfaces (M. M. Joshi *et al.* 2008).

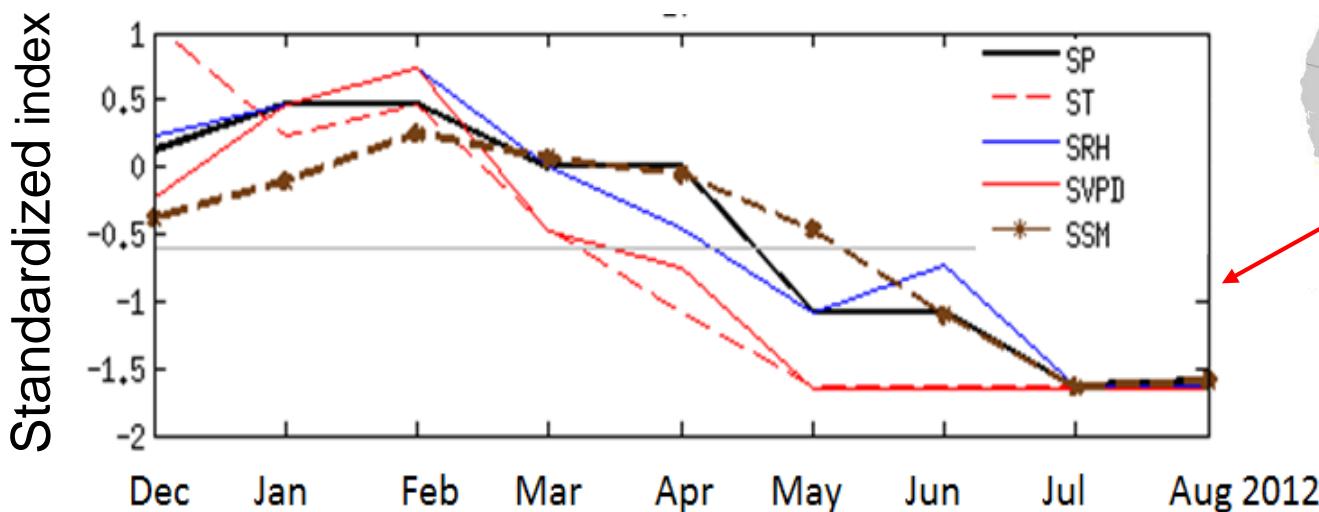
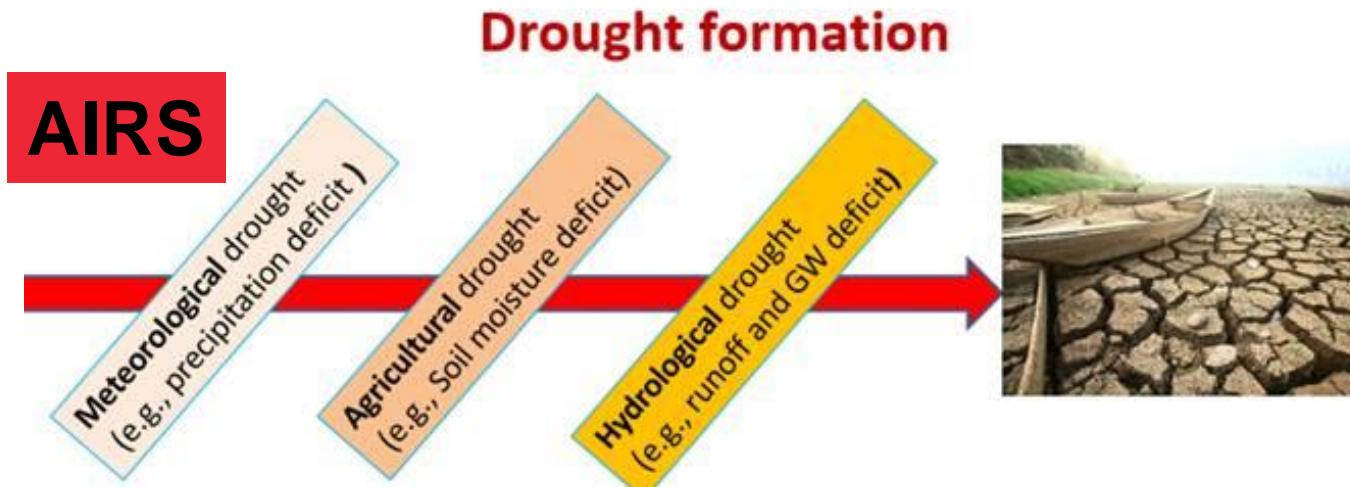


This suggests that
($\text{VPD} = e_s - e$) will increase over land

VPD =Vapor pressure deficit



Drought formation: A process

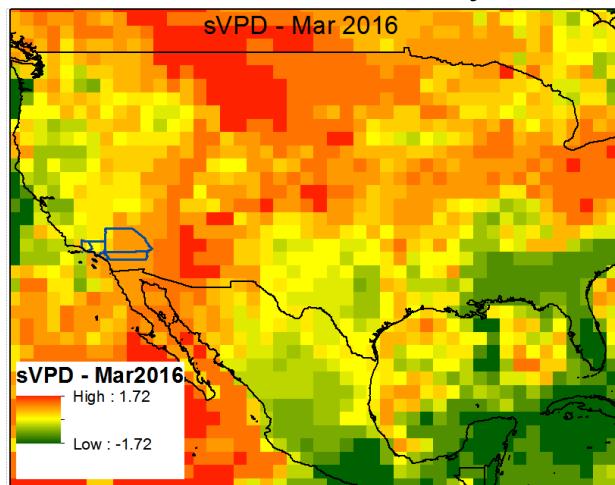


Behrangi et al. (2016)

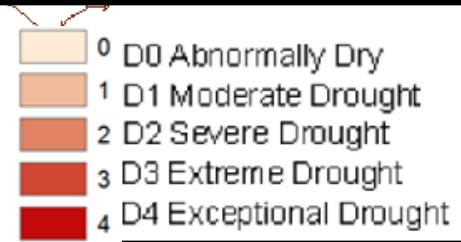
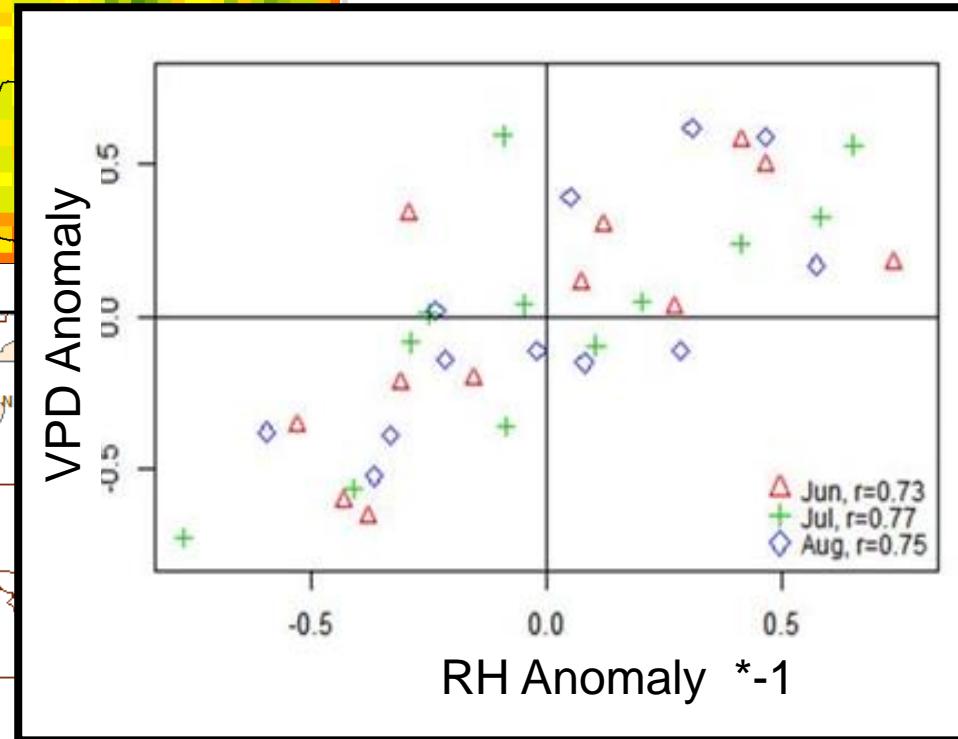
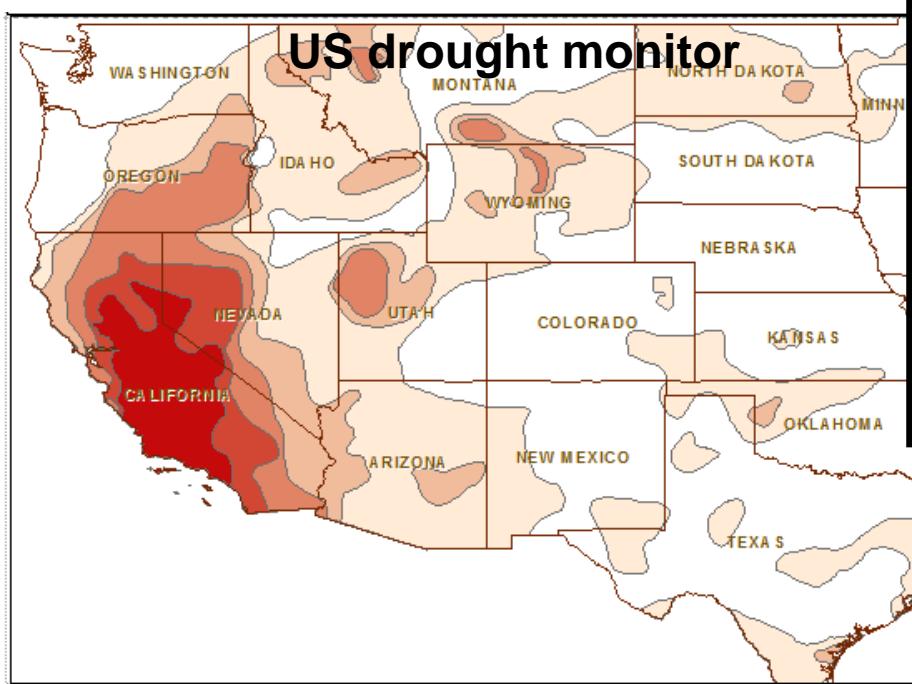
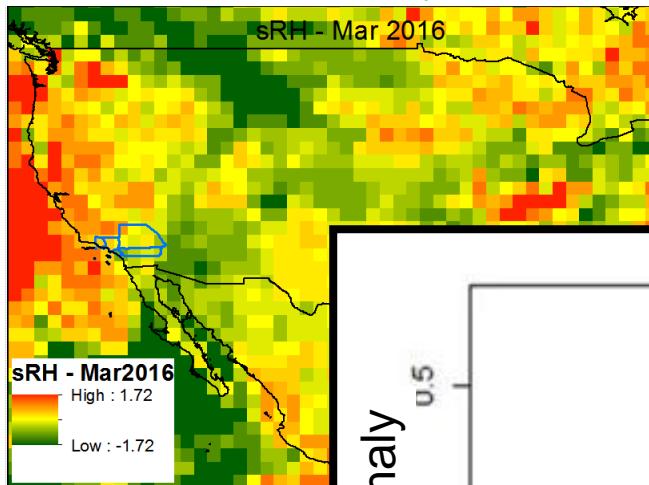
AIRS and US drought monitor (USDM)

March 2016

VPD Anomaly



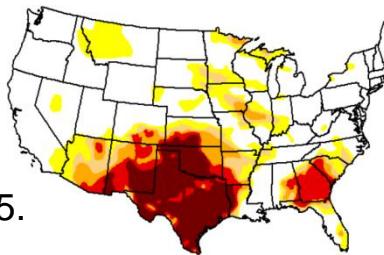
RH Anomaly



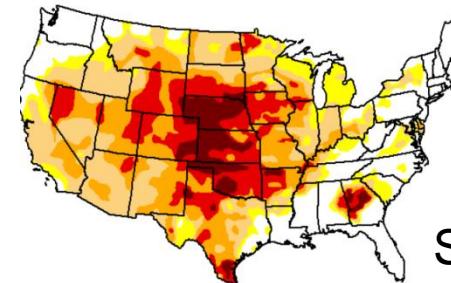
Case study

- **2011 Texas Drought**

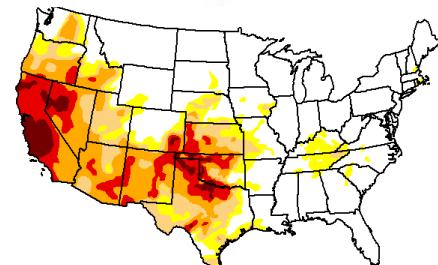
2011 drought was the worst one-year drought in Texas since 1895.



USDM
Sept

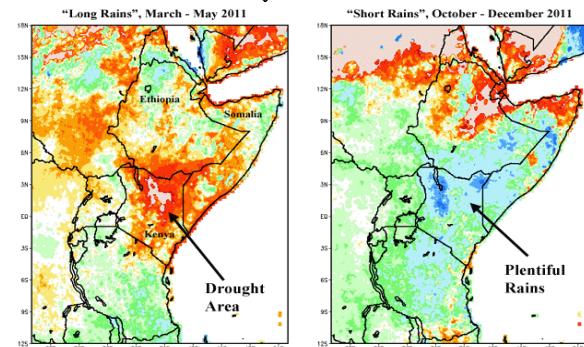


Sept



June

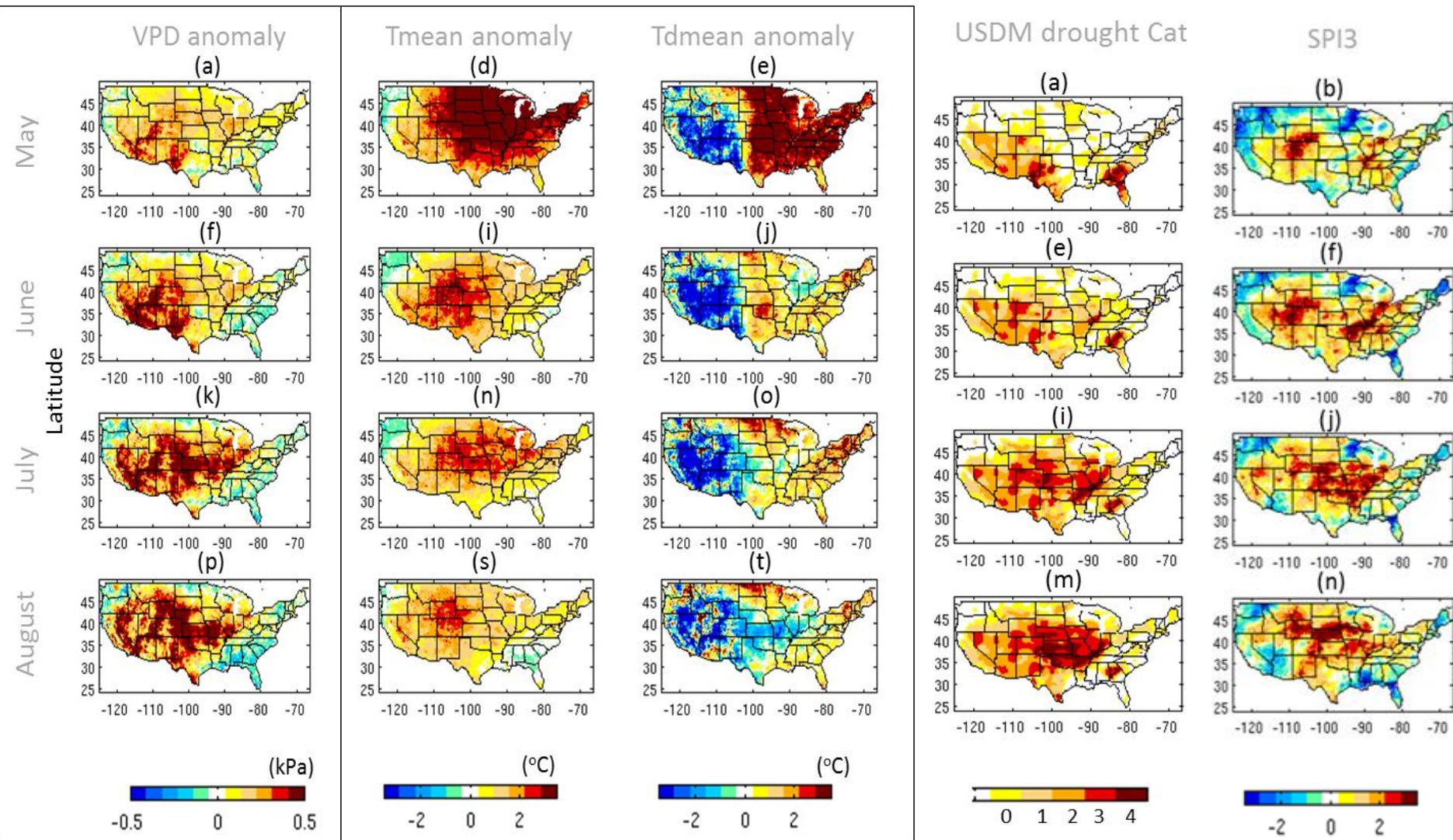
- **2014 California Drought**



- **2010-11 East Africa Drought**

AIRS helps understand drought development processes

2012 drought

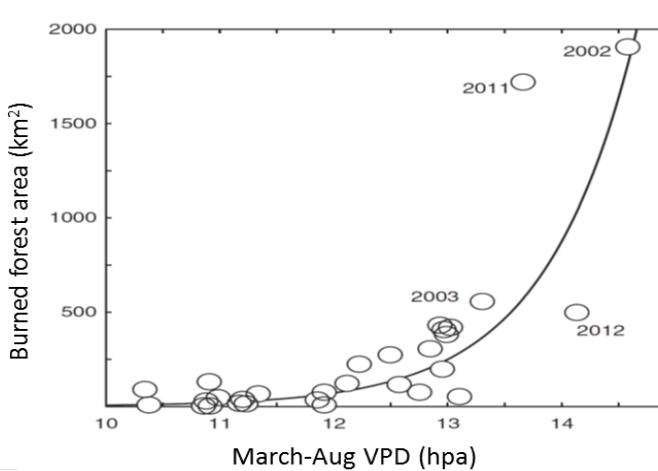
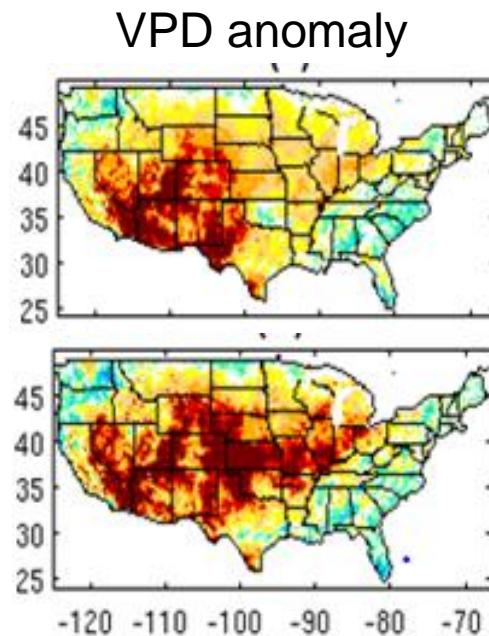


Behrangi et al. (2015)

Behrangi, A., P. Loikith, E. Fetzer, H. Nguyen, and S. Granger, 2015: Utilizing Humidity and Temperature Data to Advance Monitoring and Prediction of Meteorological Drought. *Climate*, **3**, 999-1017.

VPD and Fire

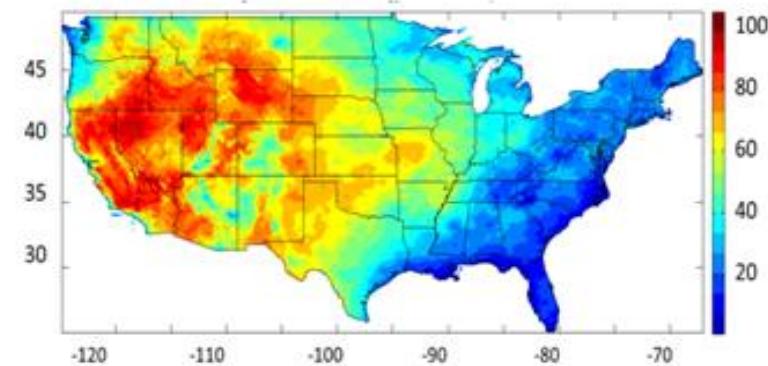
June



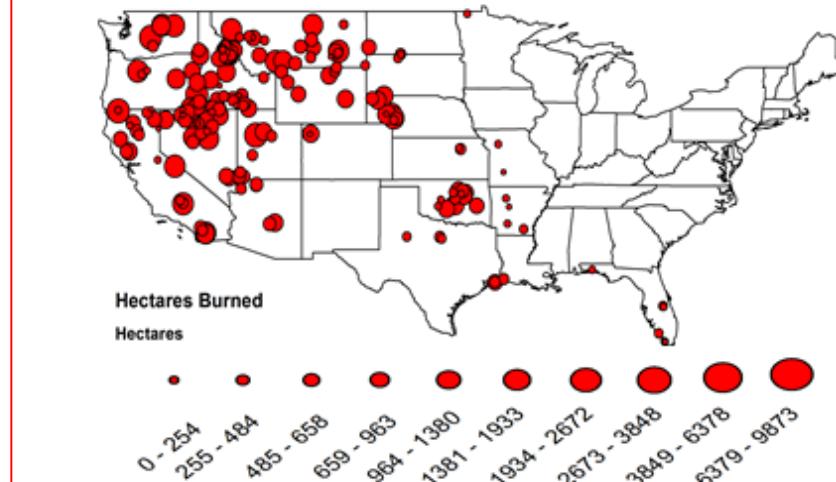
Annual burned forest area v. mean March–August VPD in SW forest area during 1894–2013. The figure is from Williams et al. (2014a)

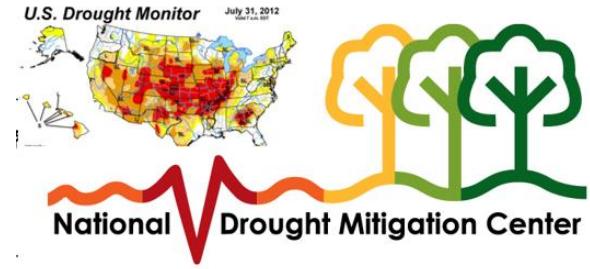
August 2012

The **national fire danger rating system (NFDRS)** energy release component (ERC)

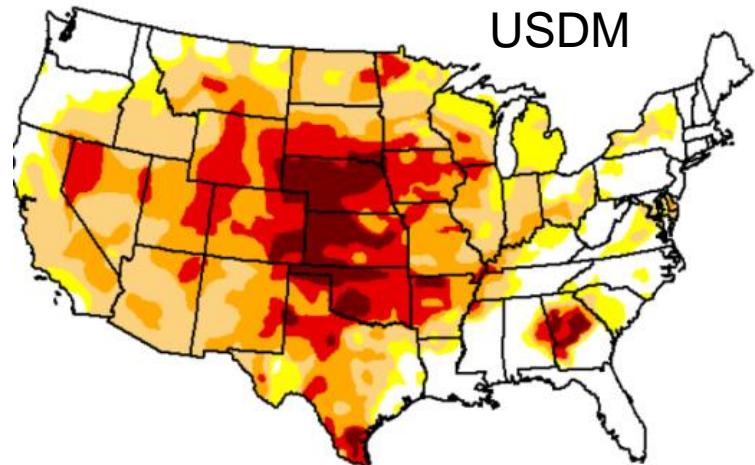


Fire occurrence : hectares burned



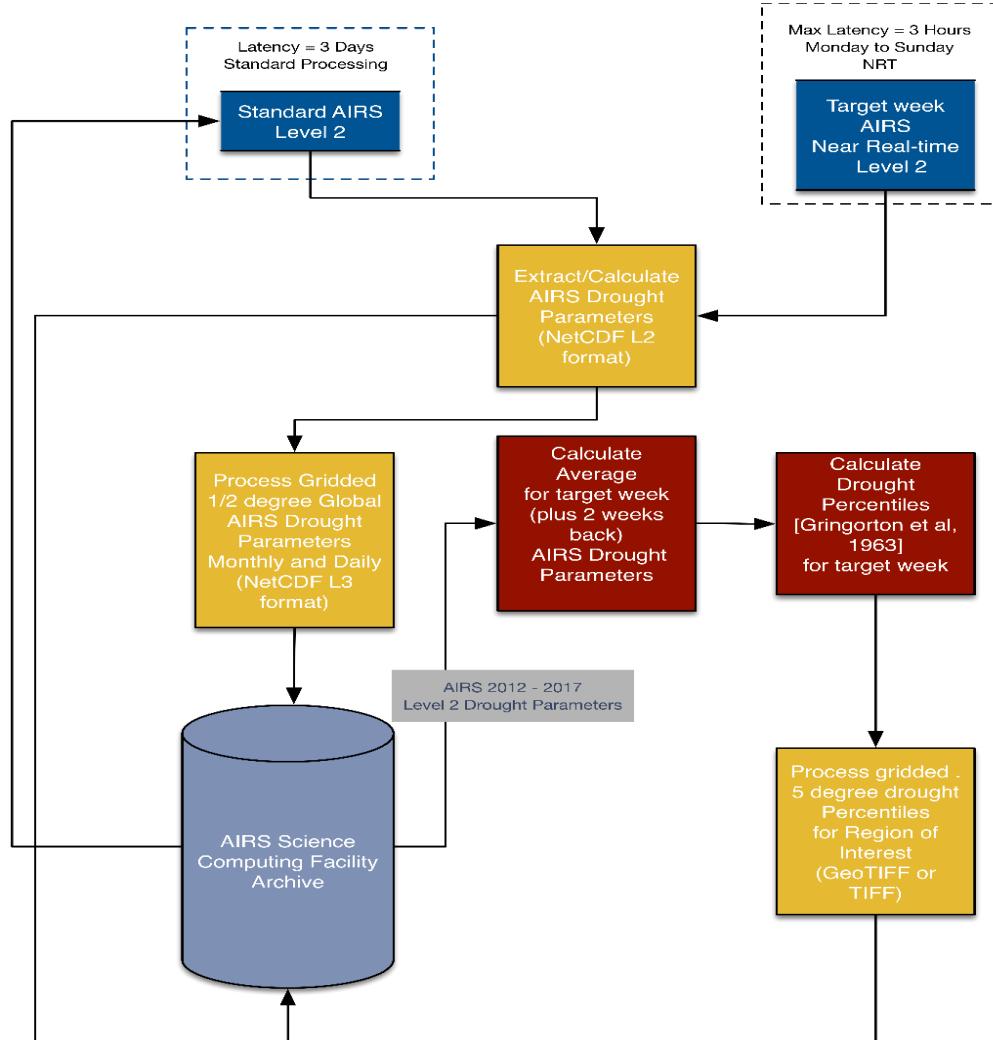


Collaboration with
The National Drought Mitigation Center (NDMC)
U.S. Drought Monitor (USDM)



AIRS Drought Percentile Products – Processing Flow

Producing $\frac{1}{2}$ degree ; Near real-time percentiles for T, RH, VPD



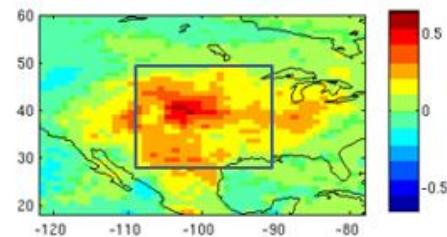
Credit:
Stephanie Granger
Steve Licata

Loss of AMSU A2:

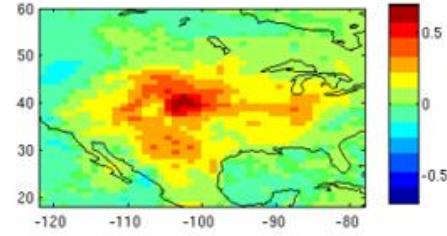
Assessing the impact of AMSU loss on drought analysis

Comparing MW-IR and IR-only retrievals over Midwest drought

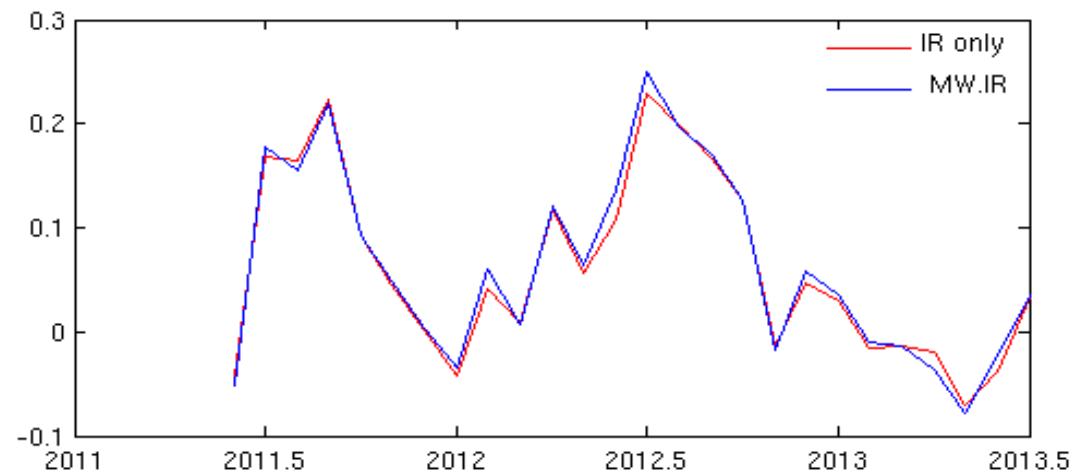
IR-only VPD anomaly



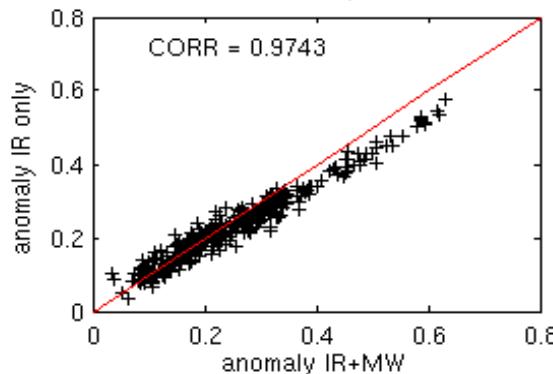
IR-MW VPD anomaly



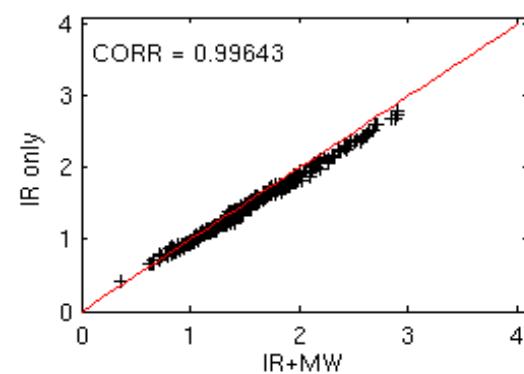
VPD Anomaly



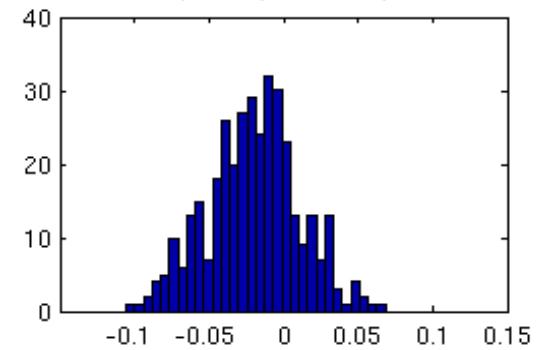
anomaly



value



anomaly IRonly - anomaly IR+W



Current Status

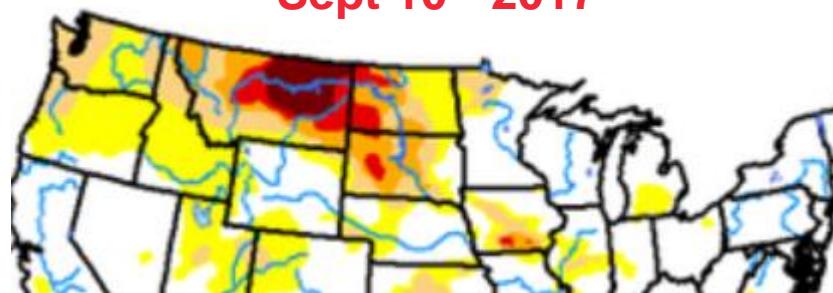
- Automated near real-time production of T, RH and VPD as percentiles for USDM
(delivered every Monday; USDM automatically pulls from our ftp site)

- Since May 2017 - USDM incorporates AIRS drought products into data stack for authors
 - 7 , 28, and 56 day window

Case study: Recent drought over Montana, N&S Dakota

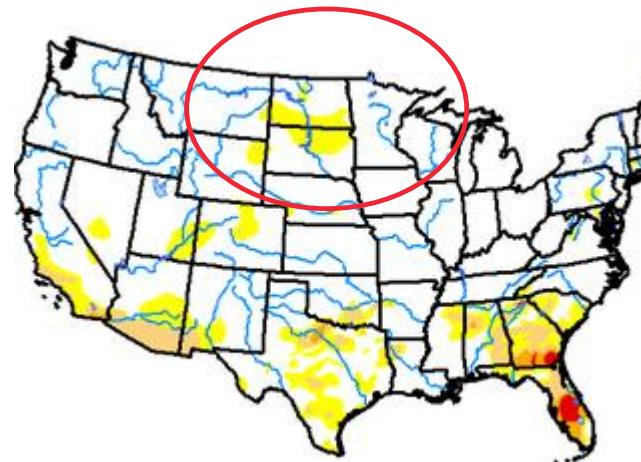


Sept 10th 2017

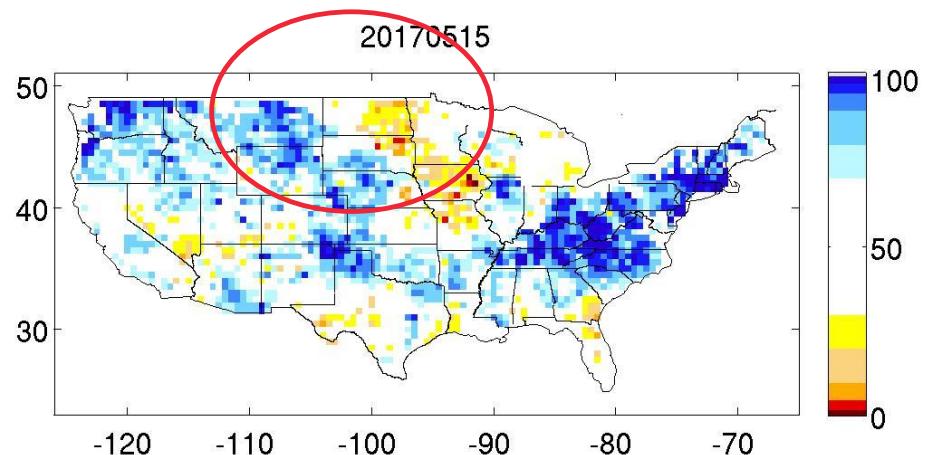


2017 05 15

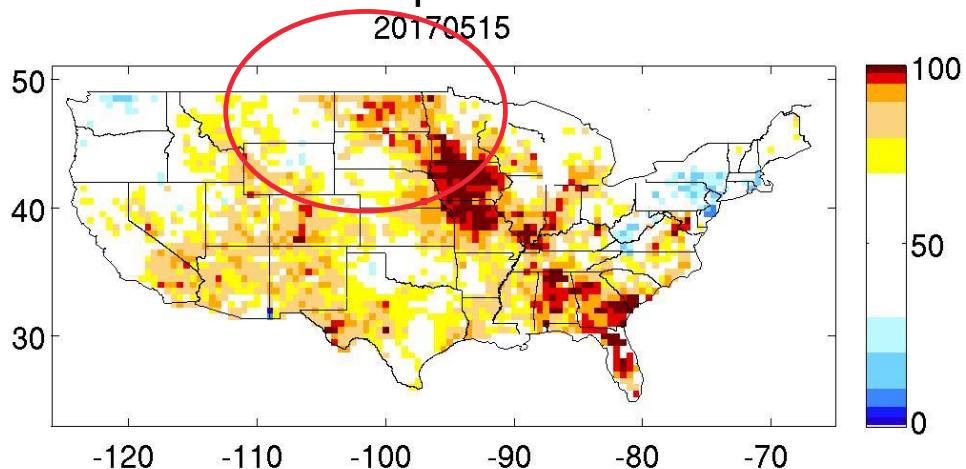
USDM



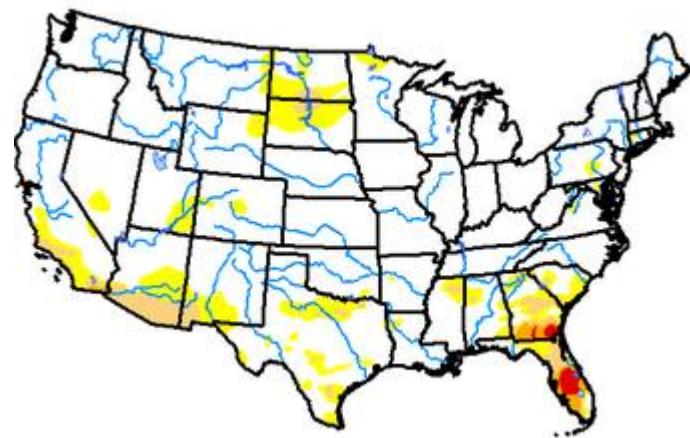
RH percentile



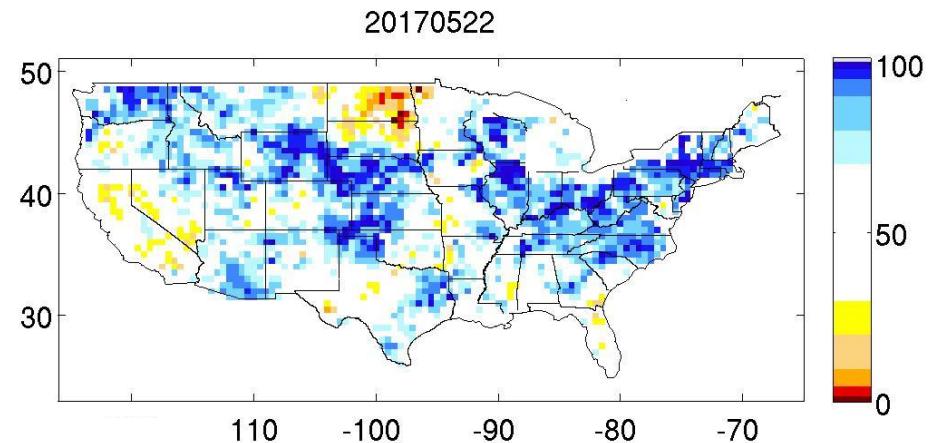
VPD percentile



USDM

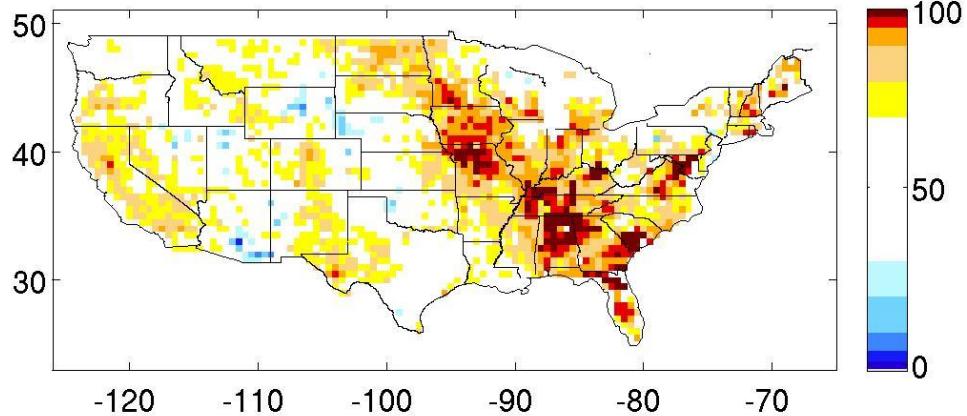


RH percentile

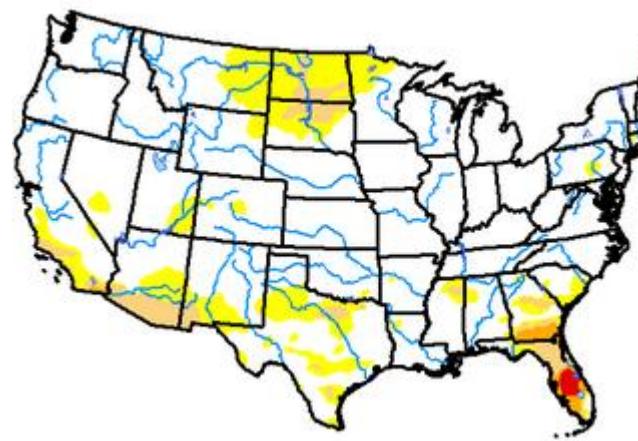


VPD percentile

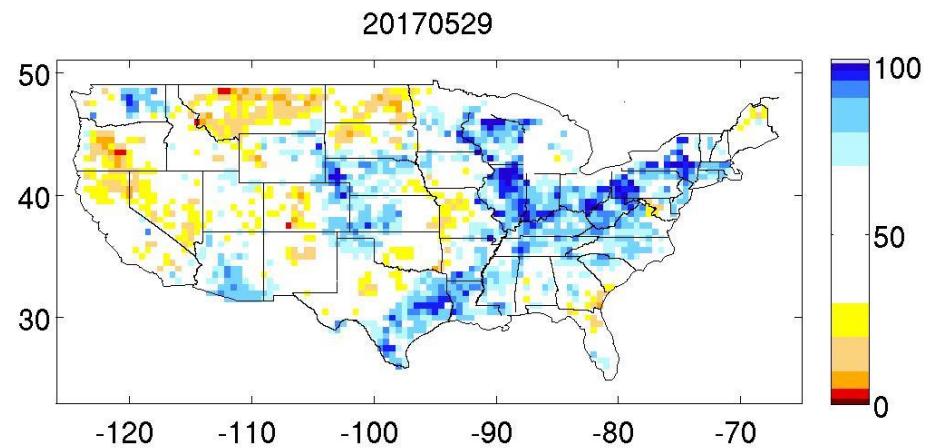
20170522



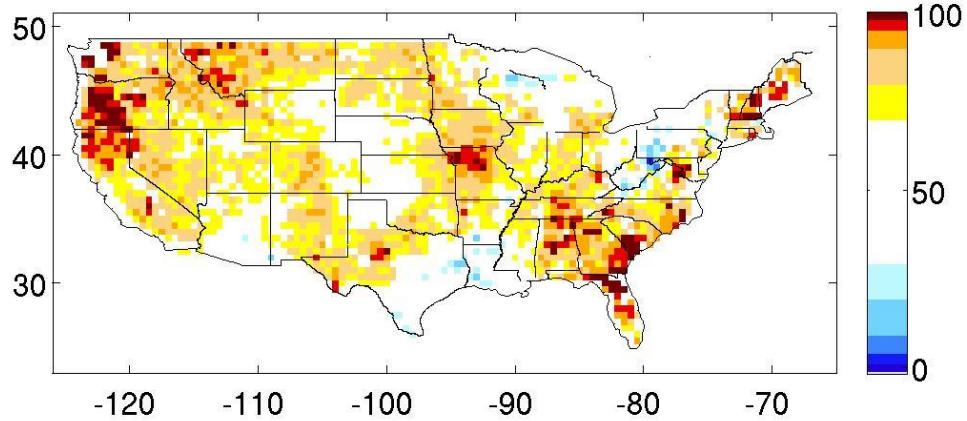
USDM



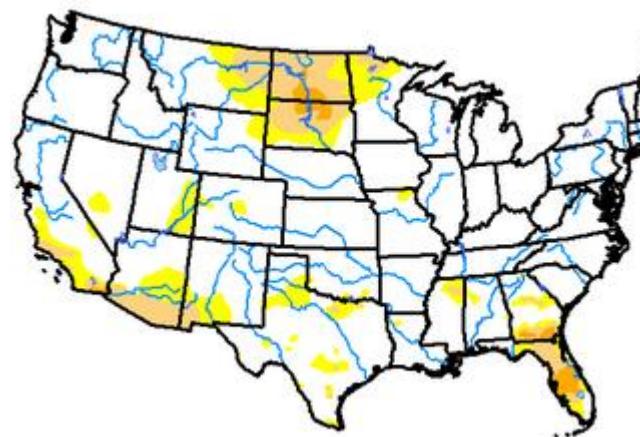
RH percentile



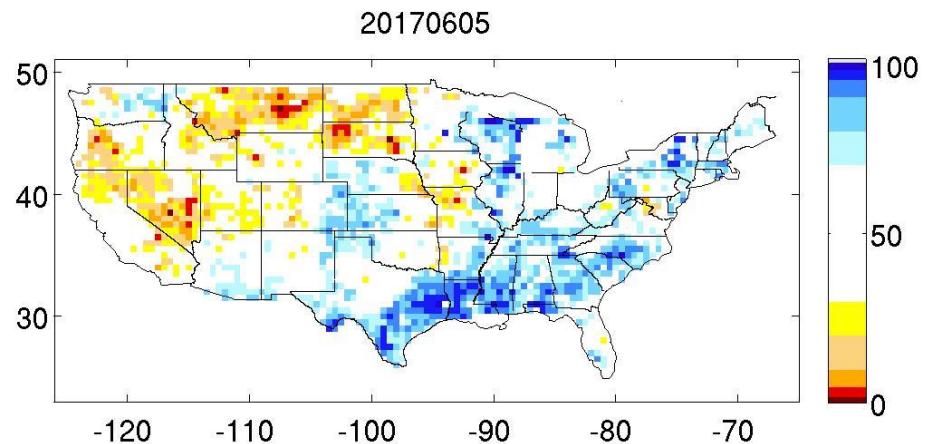
VPD percentile
20170529



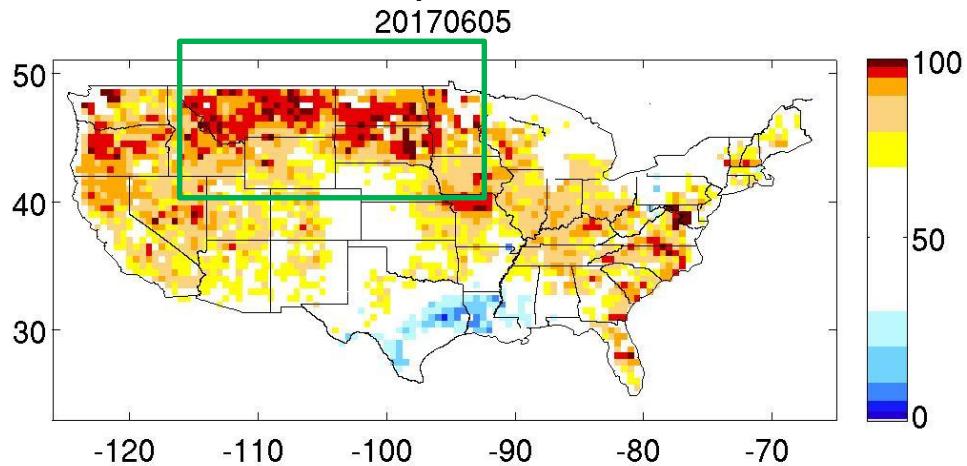
USDM



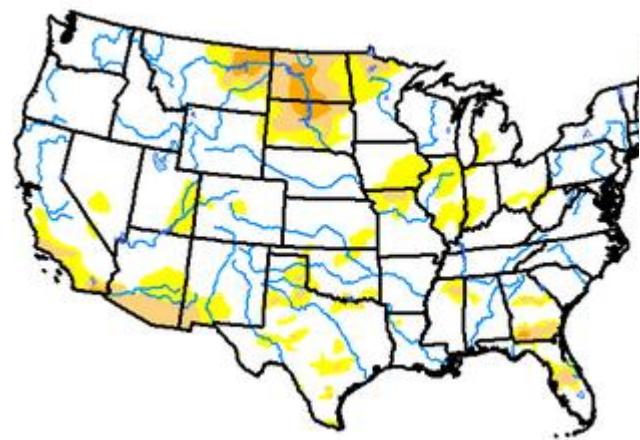
RH percentile



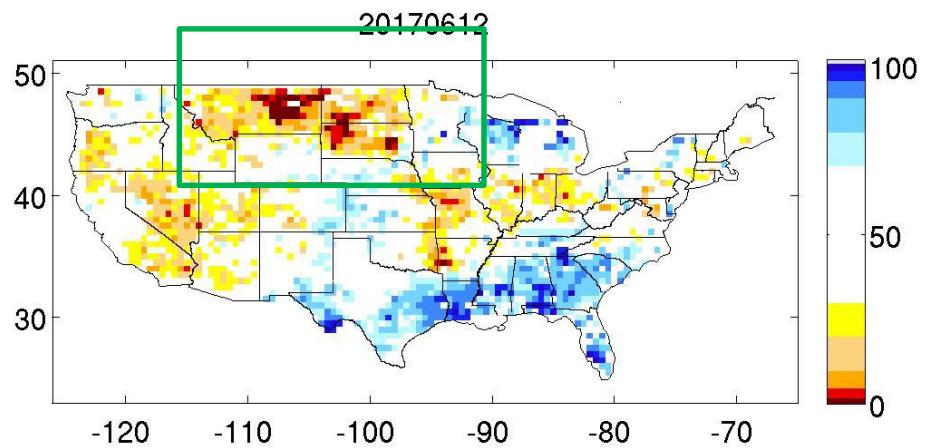
VPD percentile



USDM

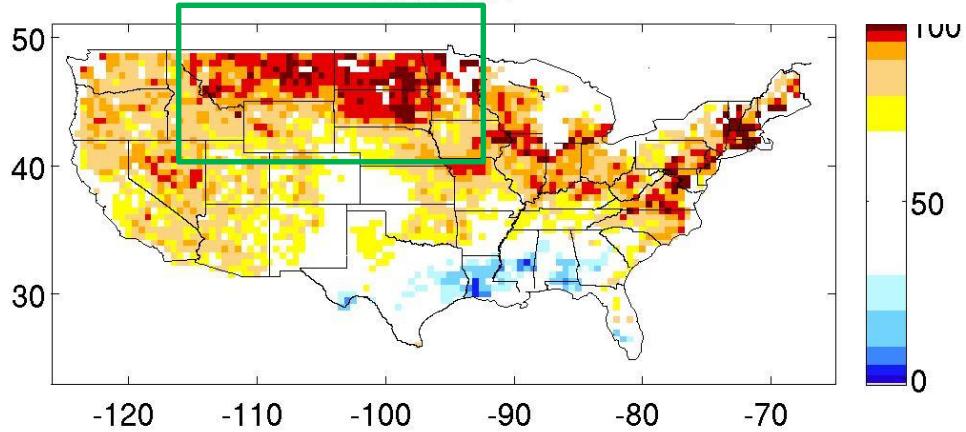


RH percentile

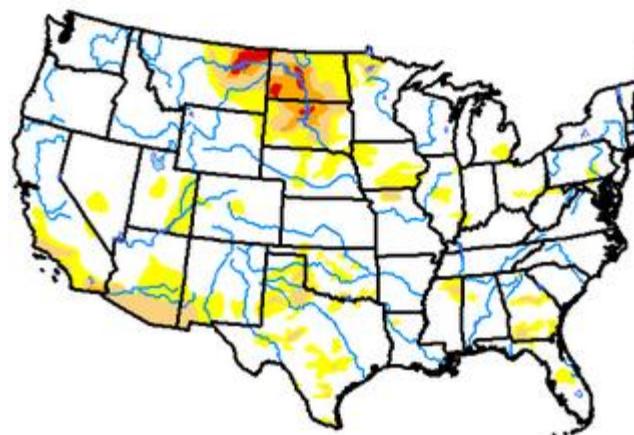


VPD percentile

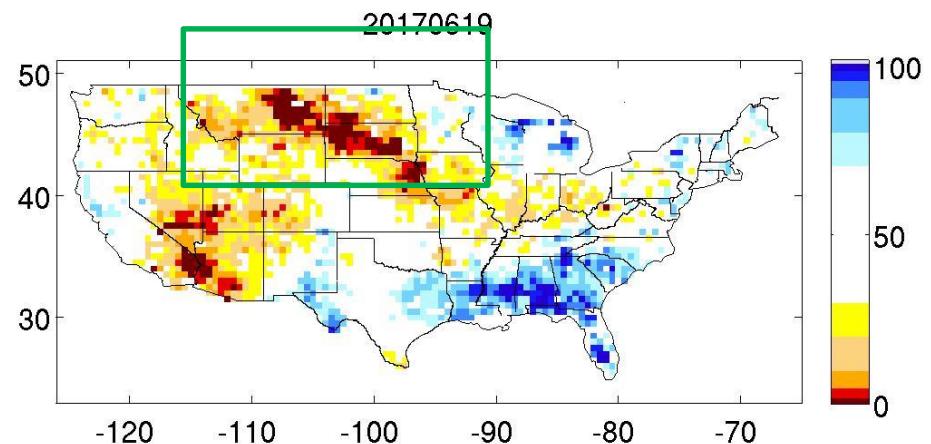
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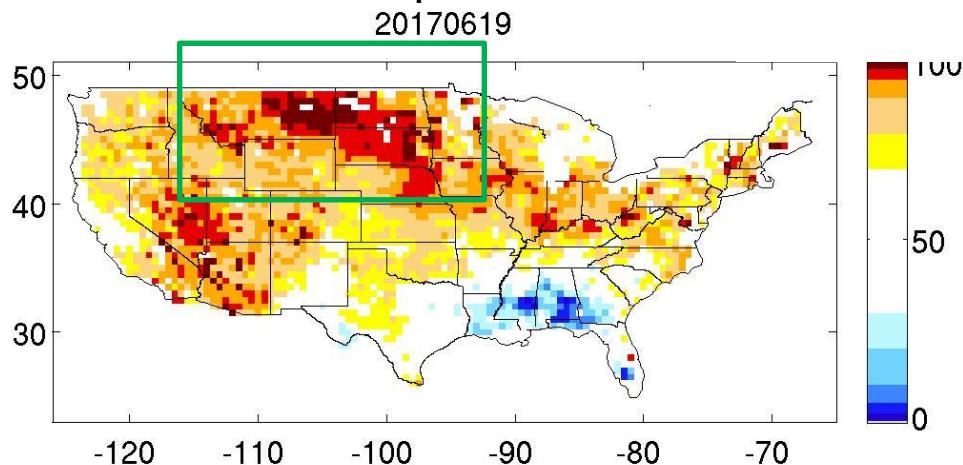
USDM



RH percentile



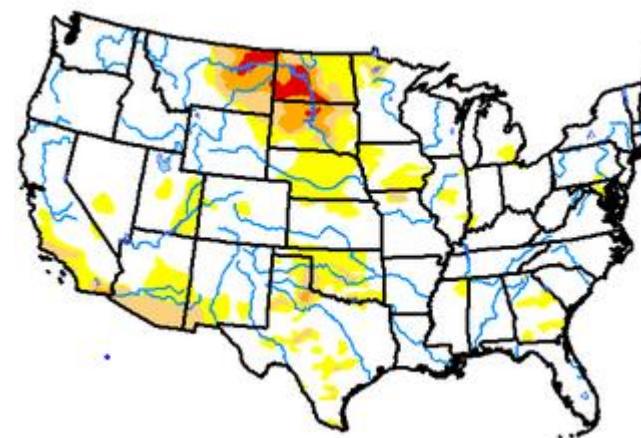
VPD percentile



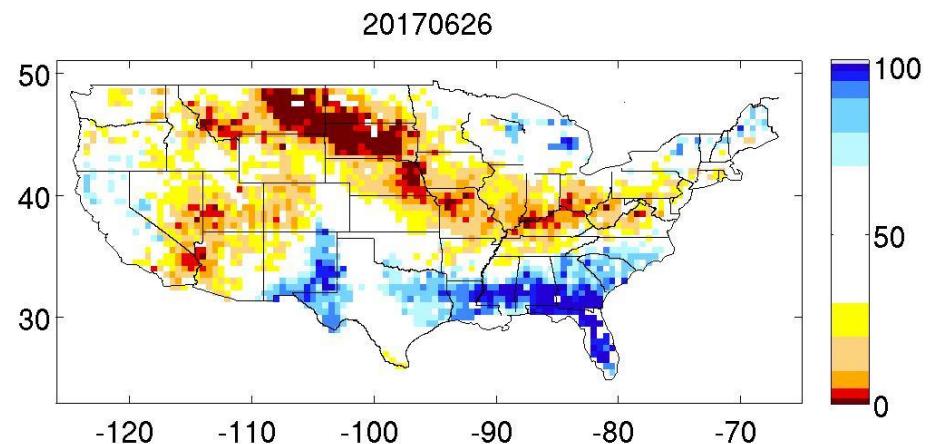
June 19th, 2017

Vegetation health NOAA START

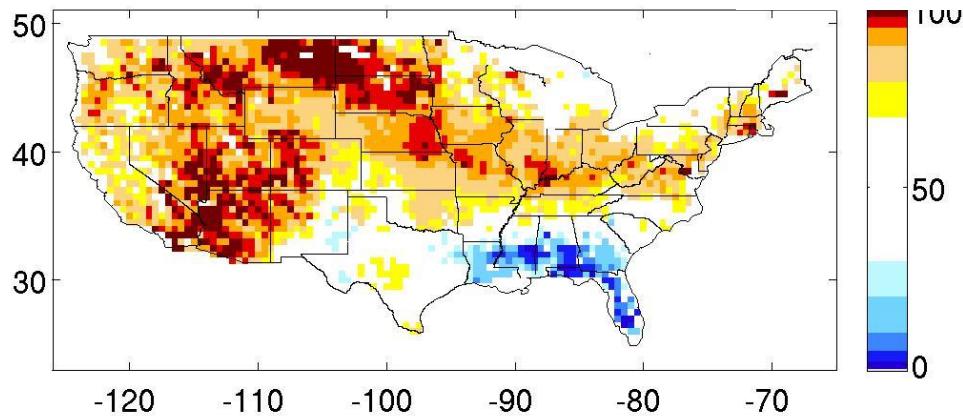
USDM



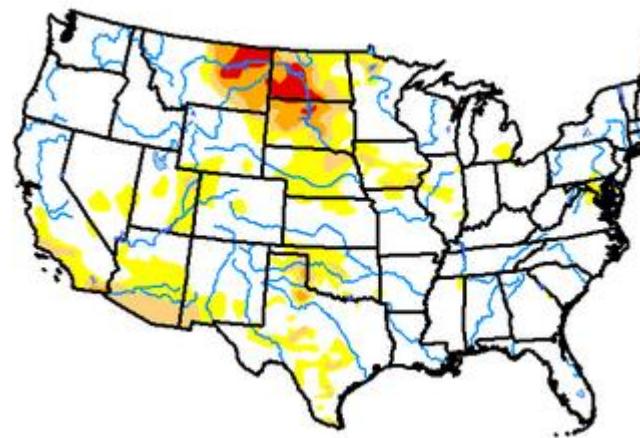
RH percentile



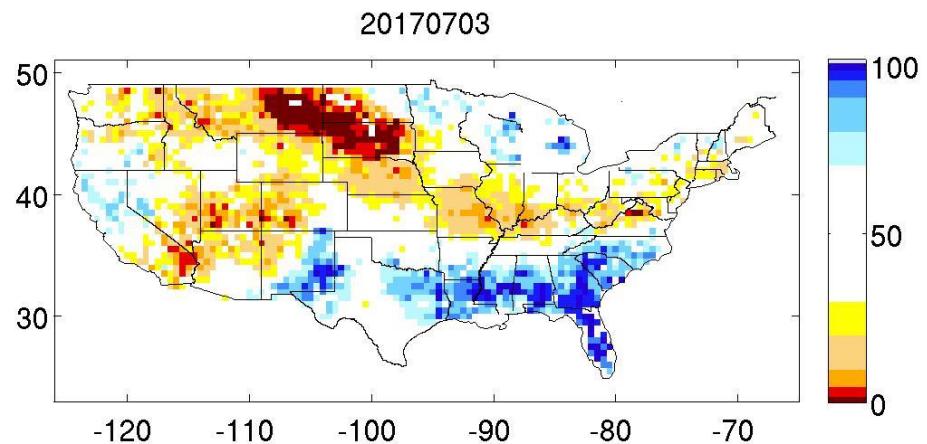
VPD percentile
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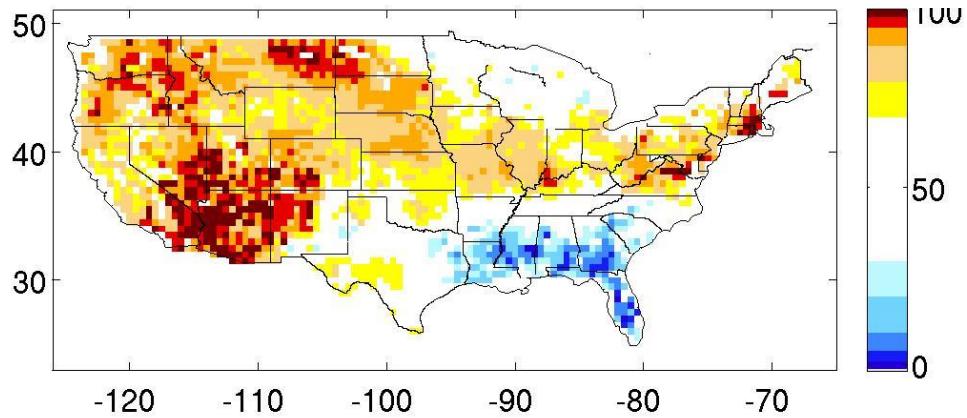
USDM



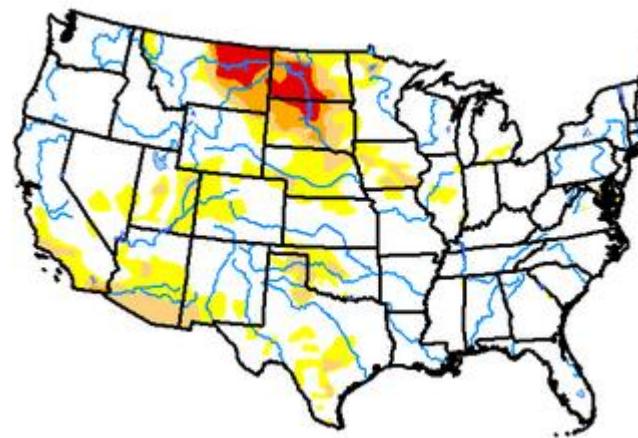
RH percentile



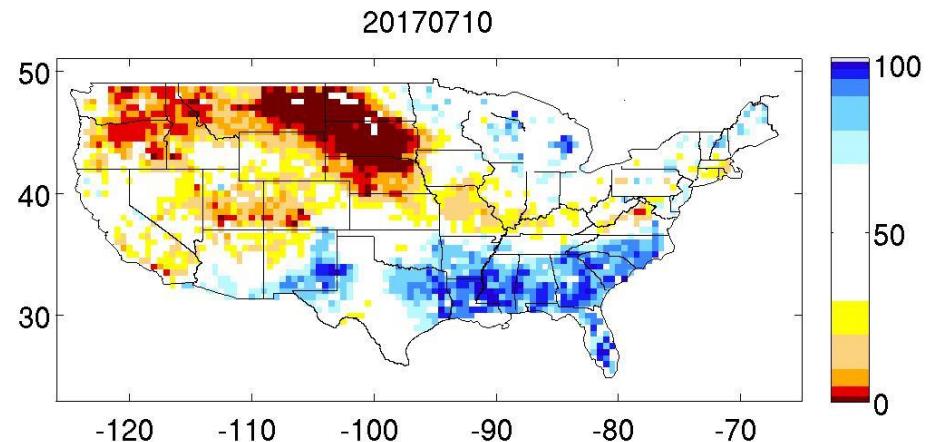
VPD percentile
20170703



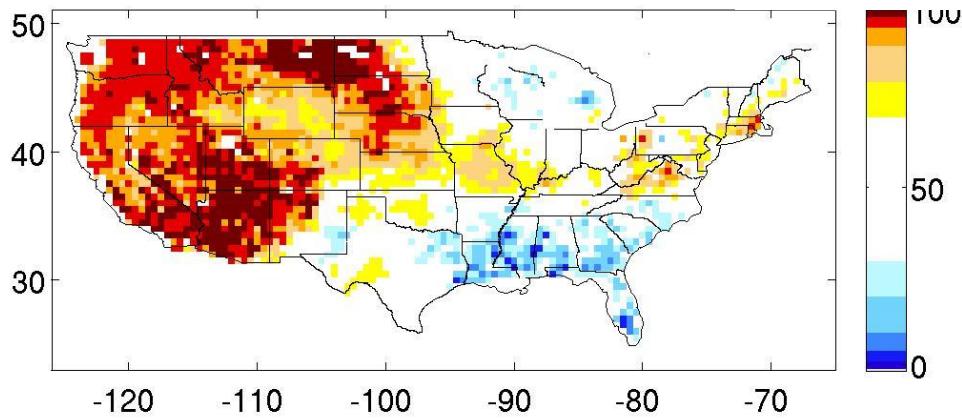
USDM



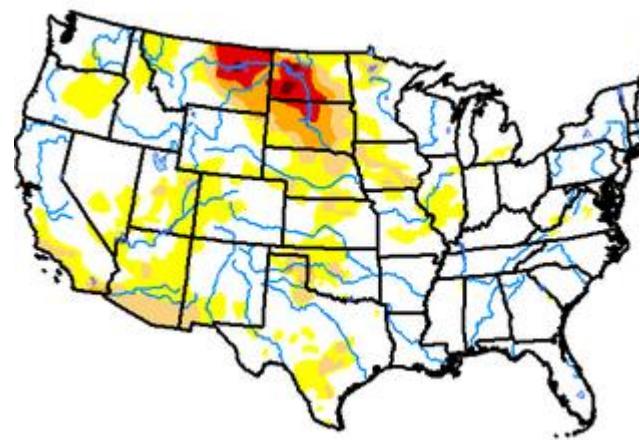
RH percentile



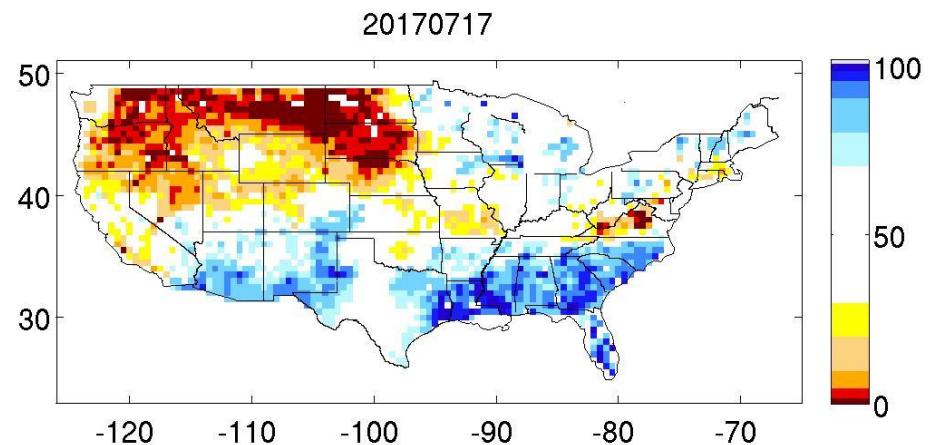
VPD percentile
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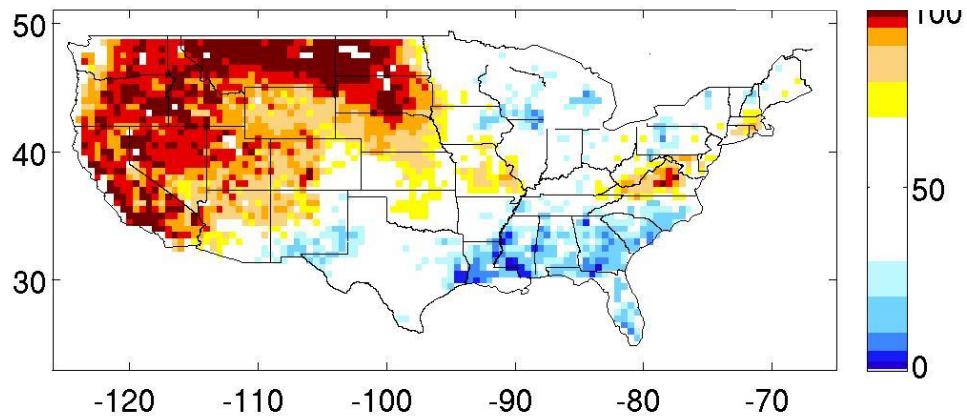
USDM



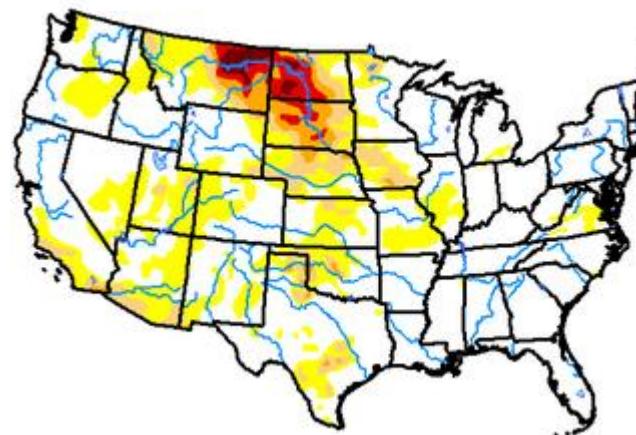
RH percentile



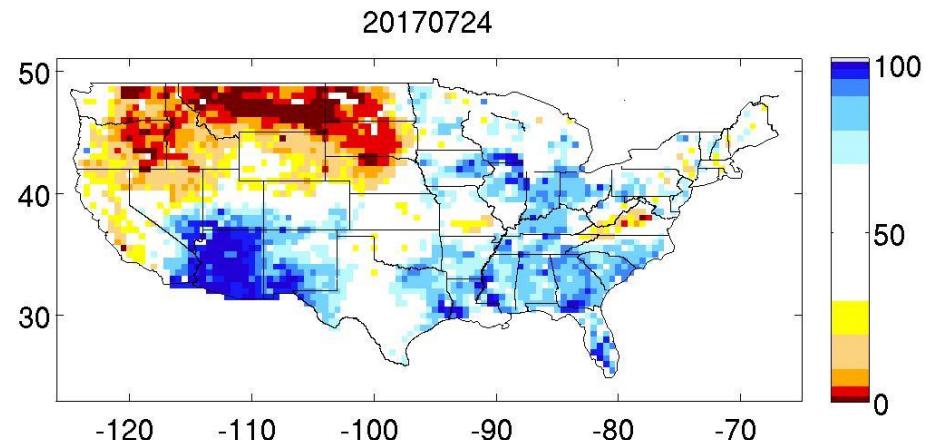
VPD percentile
20170717



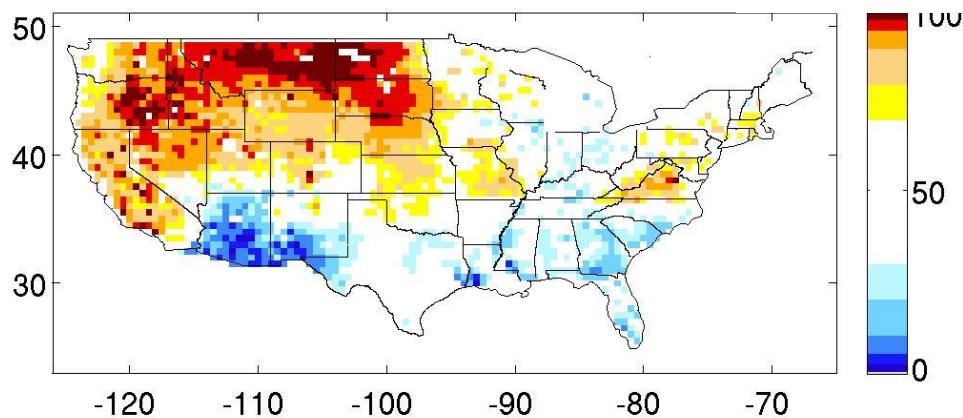
USDM



RH percentile



VPD percentile
20170724

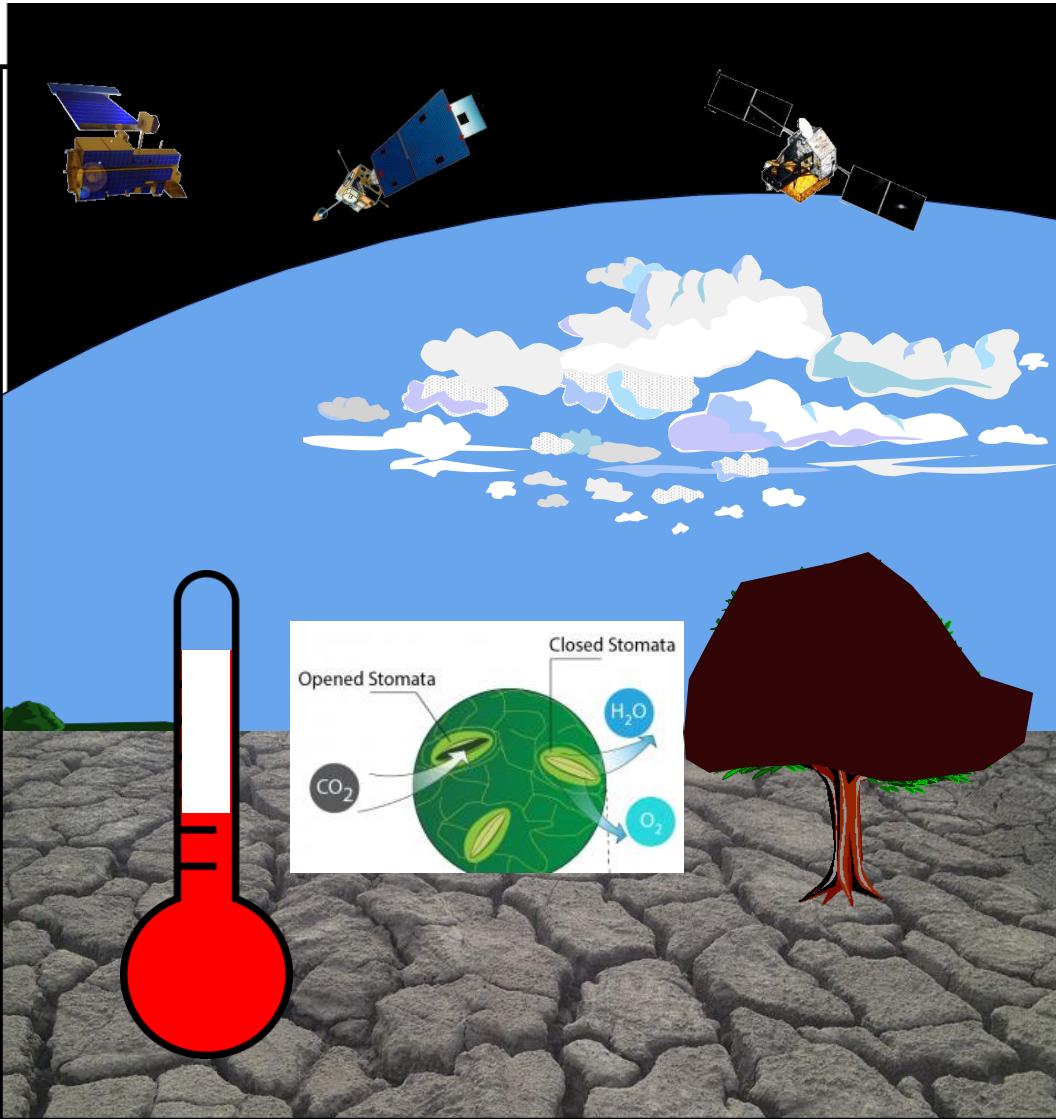


AIRS: June 19th

USDM:
July 24th, 2017

Drought development is a process:

Relating VPD, NDVI, SIF , PRECIP, Soil moisture,



Environment:

- T \uparrow RH \downarrow VPD \uparrow
- Precipitation \downarrow
- Soil Moisture \downarrow

Vegetation:

- SIF \downarrow
- NDVI \downarrow

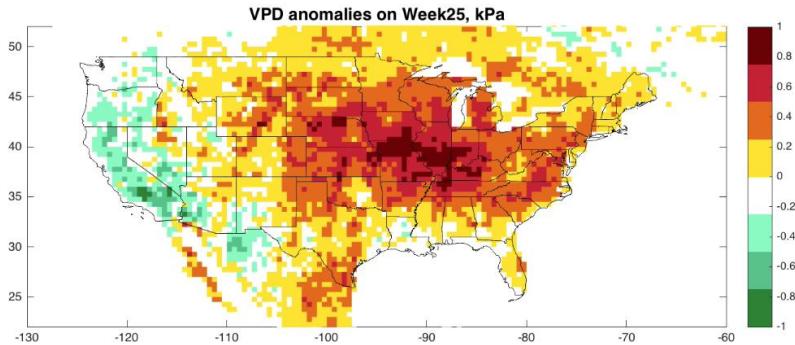
Credit: Yixin Wen

SIF: solar-induced chlorophyll fluorescence

Example: Timing of the peak drought conditions in 2012

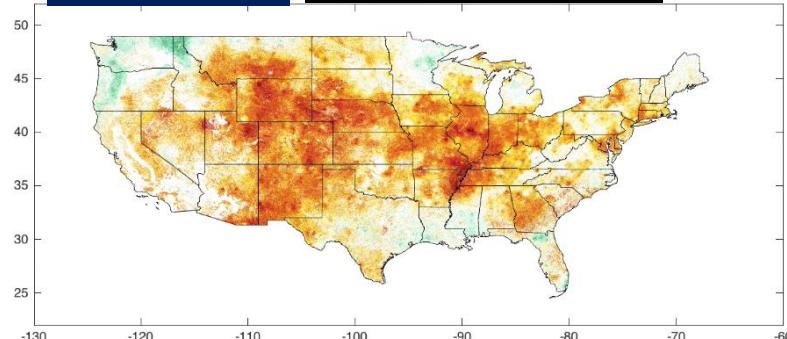
Using VPD anomaly, USDM, VegDRI and QuickDRI

VPD July 1, 2012



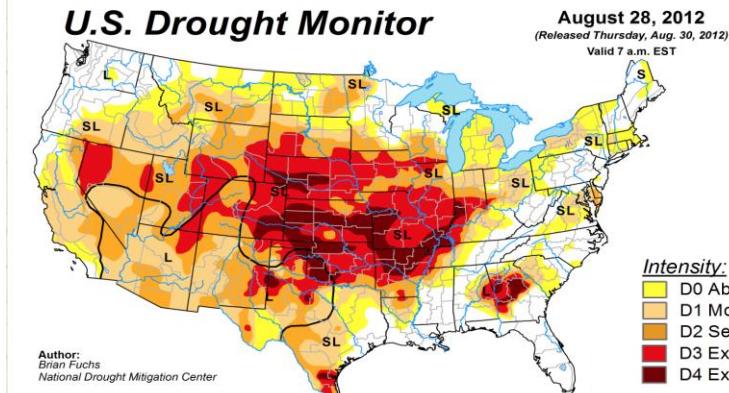
+2 month

VegDRI Sep 2, 2012



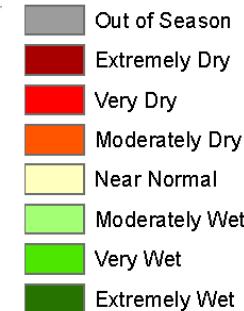
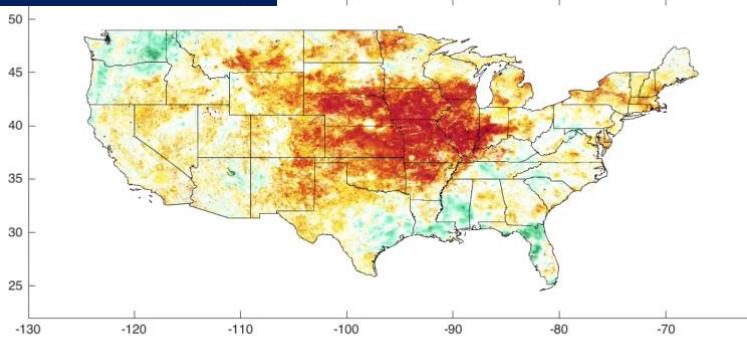
+2 month

USDM August 28,



+1/2 month

QuickDRI July 15, 2012



Future Work

- Continue to work with National Drought Mitigation Center (USDM) to refine products
- Assessing irrigated/non-irrigated regions
- Combining the AIRS data with other related observations (e.g., VPD and Soil moisture)
- Utilize our results in decision making process:

Concept submitted to WWAO to support Missouri Basin Drought Early Warning System
(Granger/Behrangi/Svoboda)

- Sustainability of data record (e.g., via NPP, etc.)